

Fast Beam Loss Monitoring Power Supply Control Loop for the New Muon Lab Machine Protection System

Bailey W. Wilkinson (Heartland Community College, Normal, IL 61761), Arden Warner (Fermi National Accelerator Laboratory, Batavia, IL 60510).

ABSTRACT

The beam at Fermilab's New Muon Lab, when operational, will need systems to protect the apparatus from excessive beam loss, collisions with the beam pipe, inadequate vacuum, and various other beam-induced damages. The Machine Protection System (MPS) that is currently being designed will utilize Fast Beam Loss Monitors (FBLMs) to quickly interrupt or dynamically reduce the number of bunches produced in a beam pulse. The FBLMs are composed of a plastic scintillator attached to a photomultiplier tube (PMT) that will be used to detect ionizing radiation. Each PMT must be operated at a nearly constant voltage within a range such that the gain curve is approximately linear, which is found by measuring the gain over a range of input voltages. Maintaining a constant voltage is achieved by using a power supply with a software control loop so that minor changes can be made to the set voltage as needed. The control loop is based on a LabVIEW program provided by CAEN Technologies, Inc. for use with a different power supply model. The provided program was modified to interact with the SY2527 Universal Multichannel Power Supply System over the Transmission Control Protocol and Internet Protocol (TCP/IP), monitor the deviation of the output voltage from the set voltage, and alter a secondary set voltage such that the output voltage is equivalent to the set voltage within a reasonable accuracy. The general gain curve of one PMT was measured and plotted so that the curve could be implemented into a Field-Programmable Gate Array for use in the MPS. For, as of yet, unknown reasons, the customized LabVIEW program is unable to initialize and communicate with the power supply. In the future, the underlying C++ library could be used to find the source of the errors in the program. It may also be found useful to utilize C++ to control the power supply rather than LabVIEW.